DESIGNING OF MANIFOLD SYSTEM FOR LPG AND INDUSTRIAL GAS AT FKKSA'S LABORATORY

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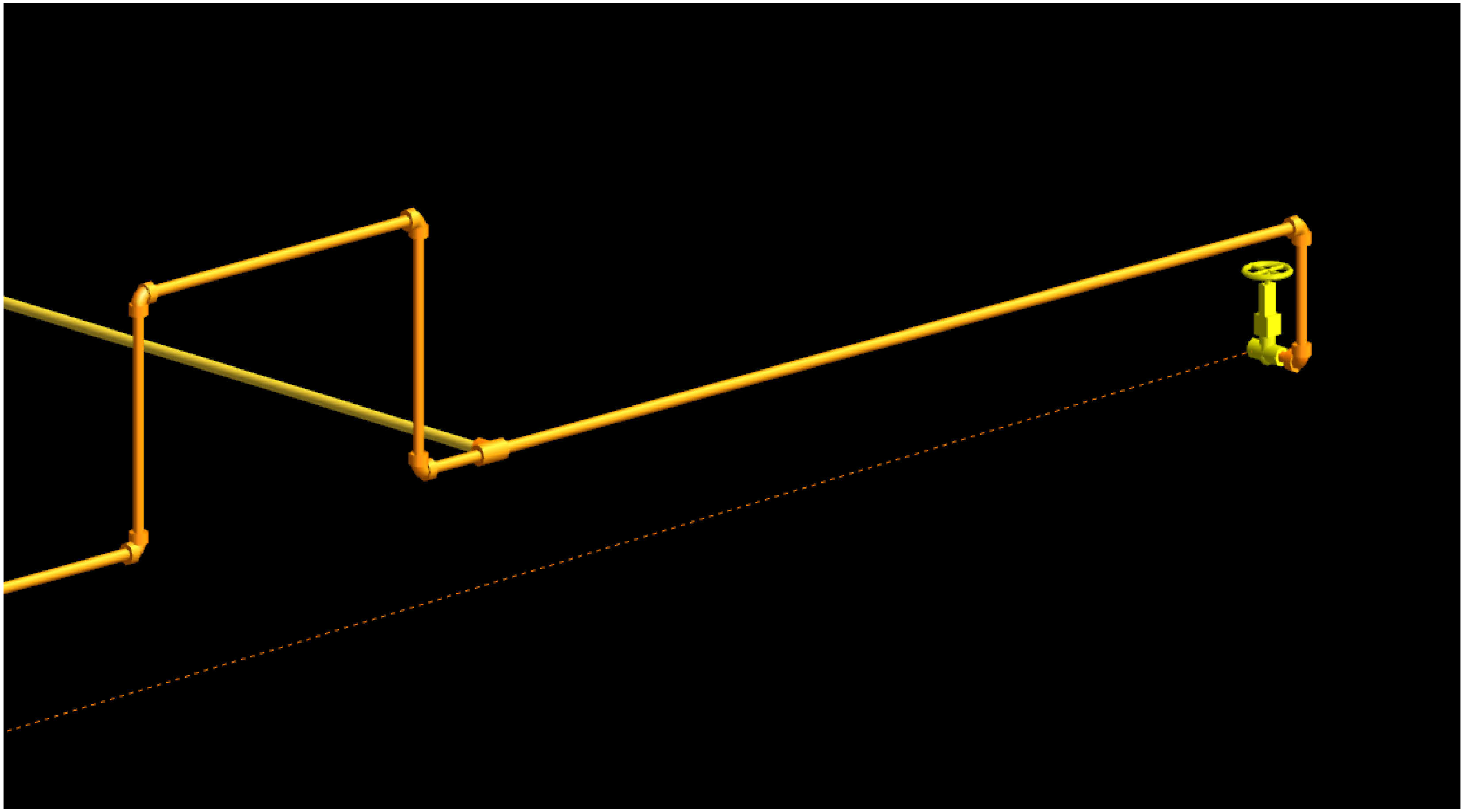

Figure 4.3: Tubing layout at Gas Engineering Lab (3D review)

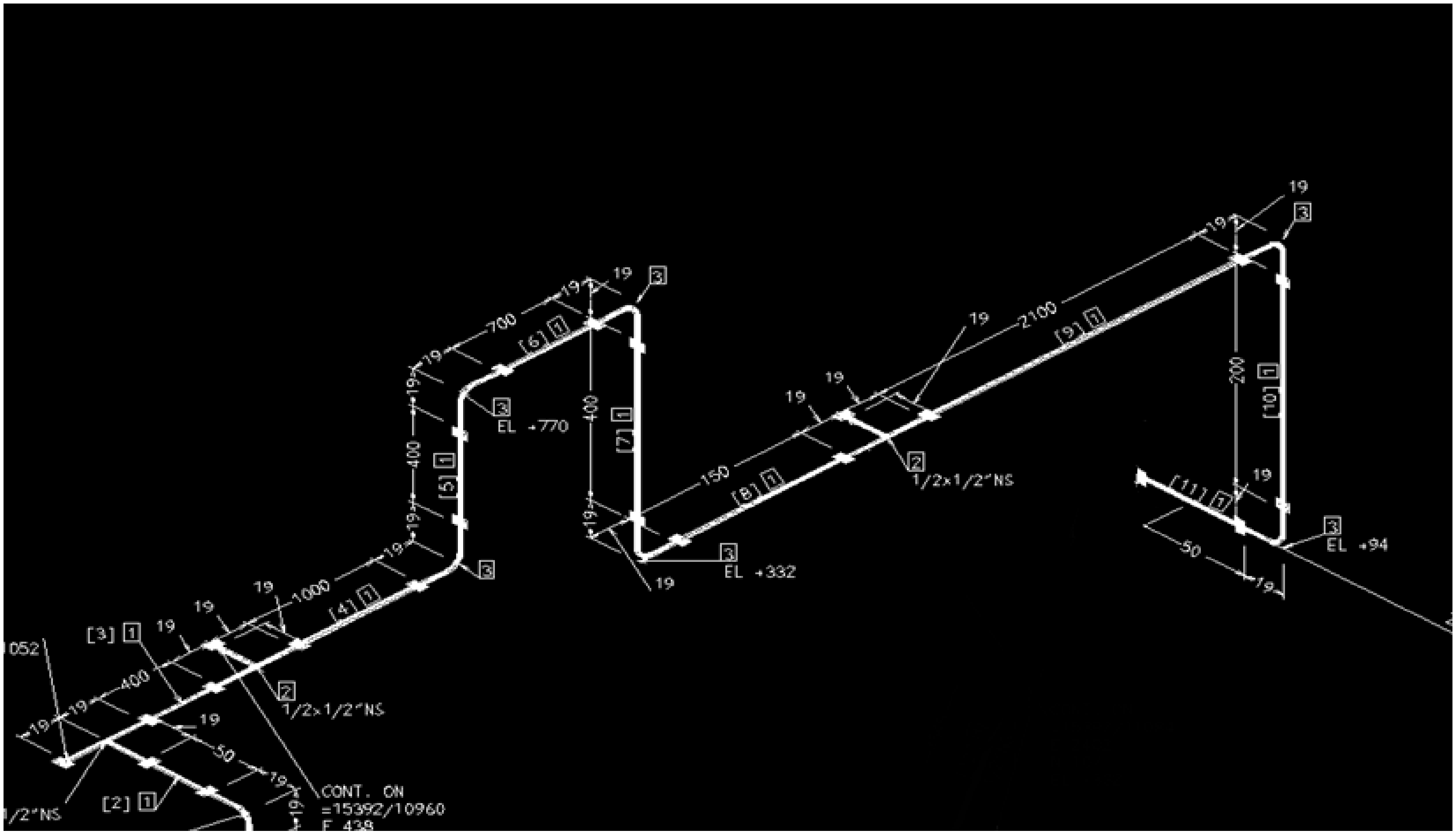

Figure 4.4: Tubing layout at Gas Engineering Lab (Isometric review)

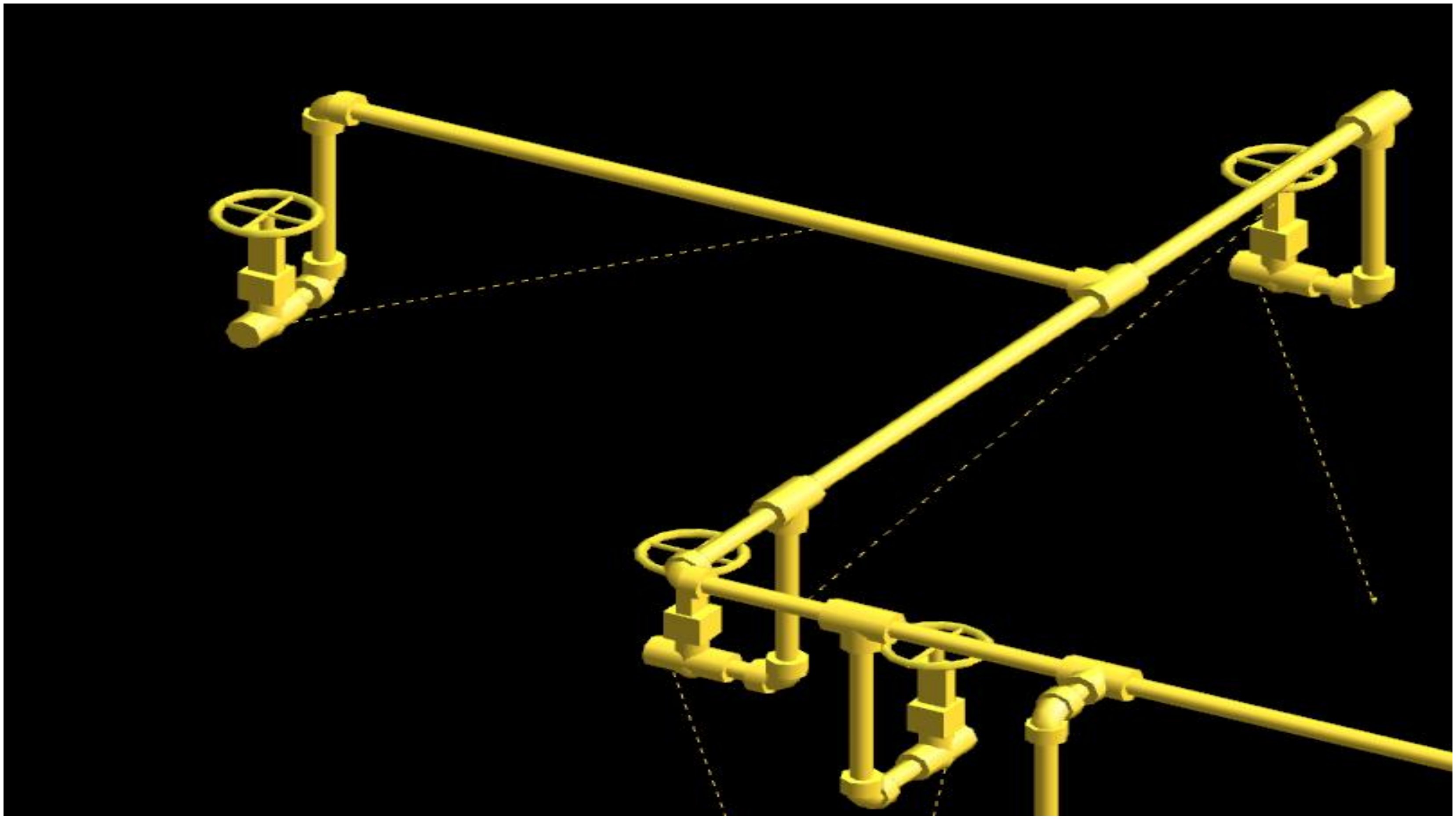

Figure 4.5: Tubing layout at Bio Analytical Lab, Analytical Cool Lab and Analytical Hot Lab (3D review)

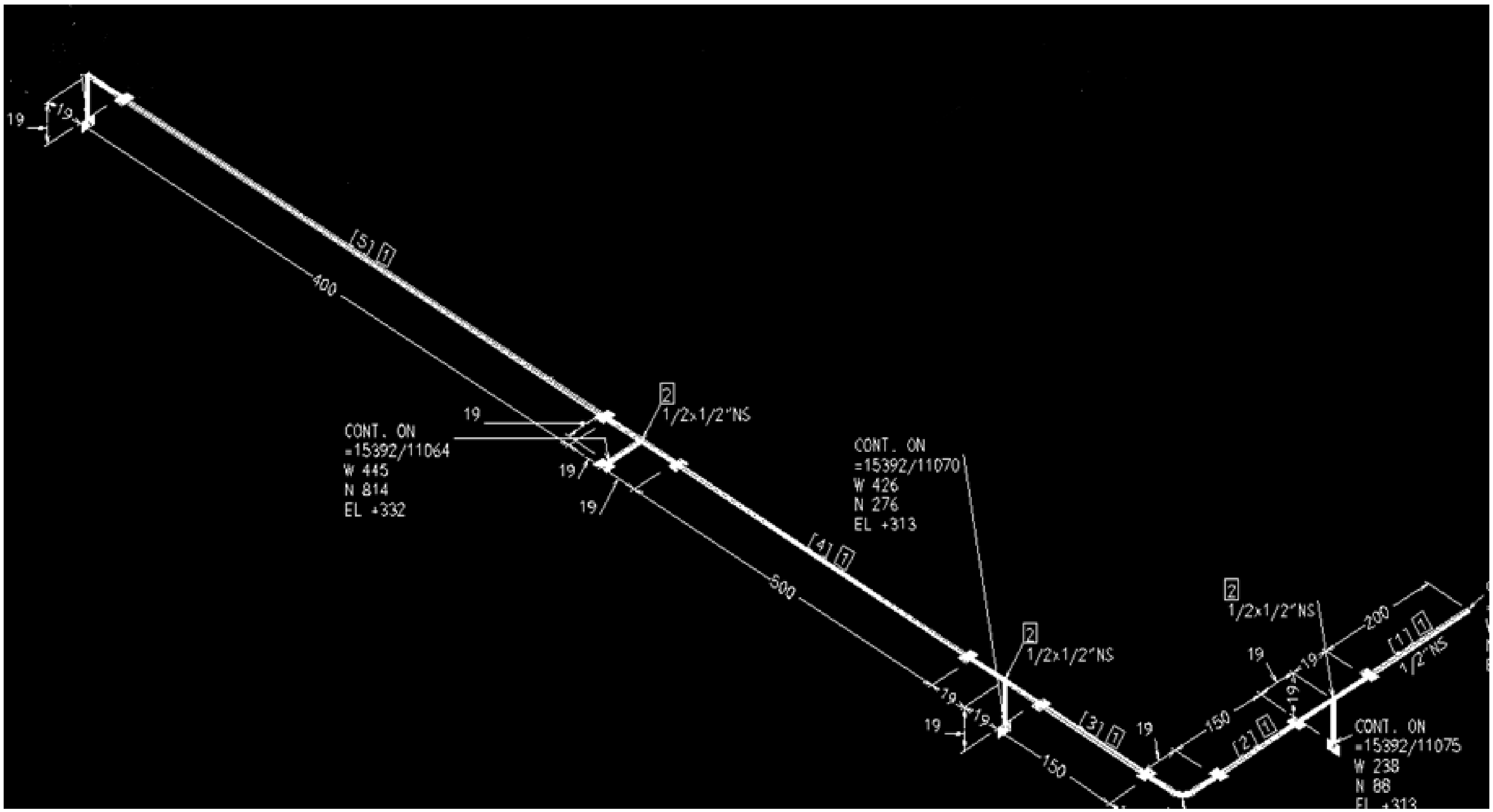

Figure 4.6: Tubing layout at Bio Analytical Lab, Analytical Cool Lab and Analytical Hot Lab (Isometric review)

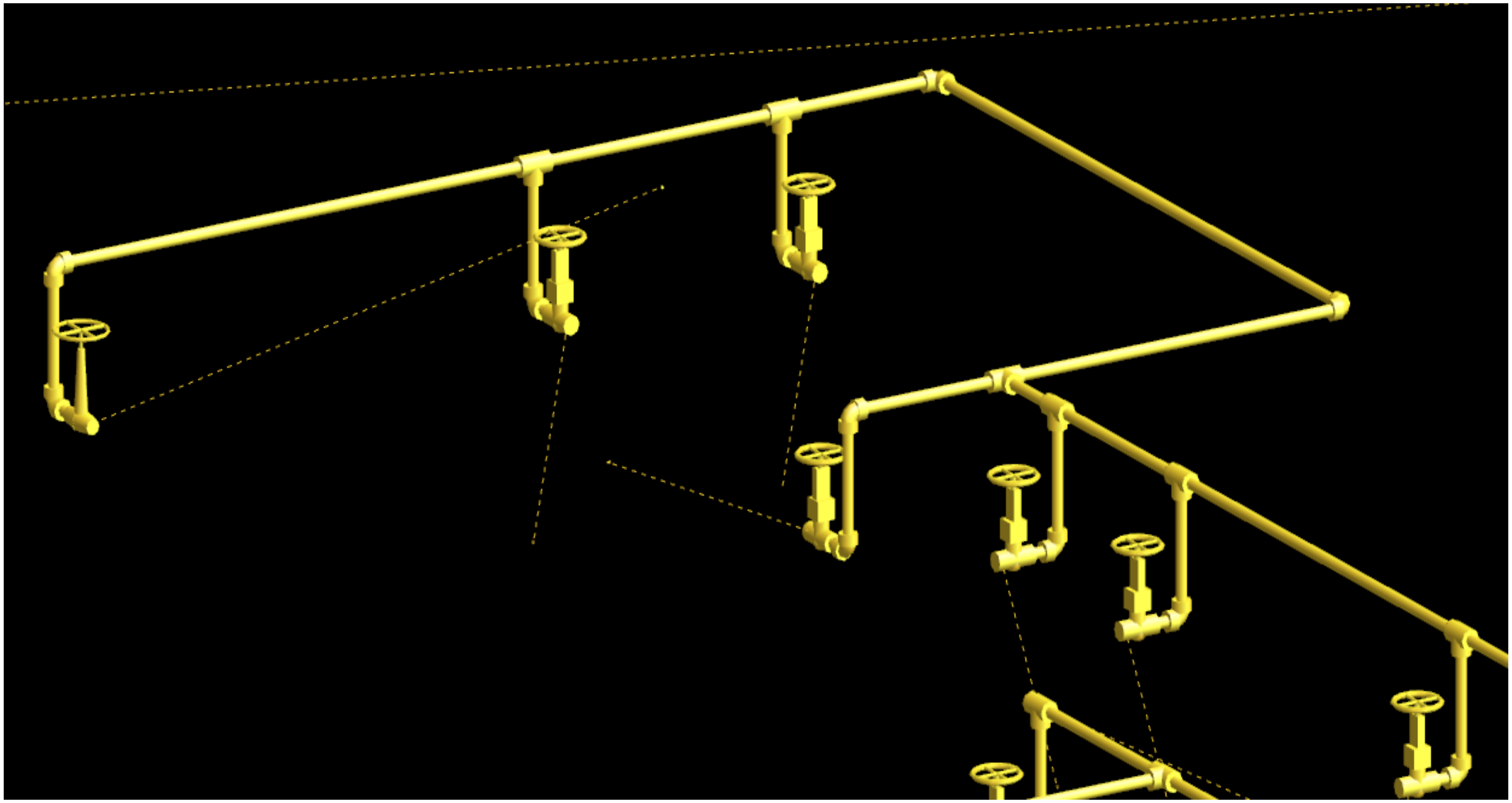

Figure 4.7: Tubing layout at Biotech Lab 2 (3D review)

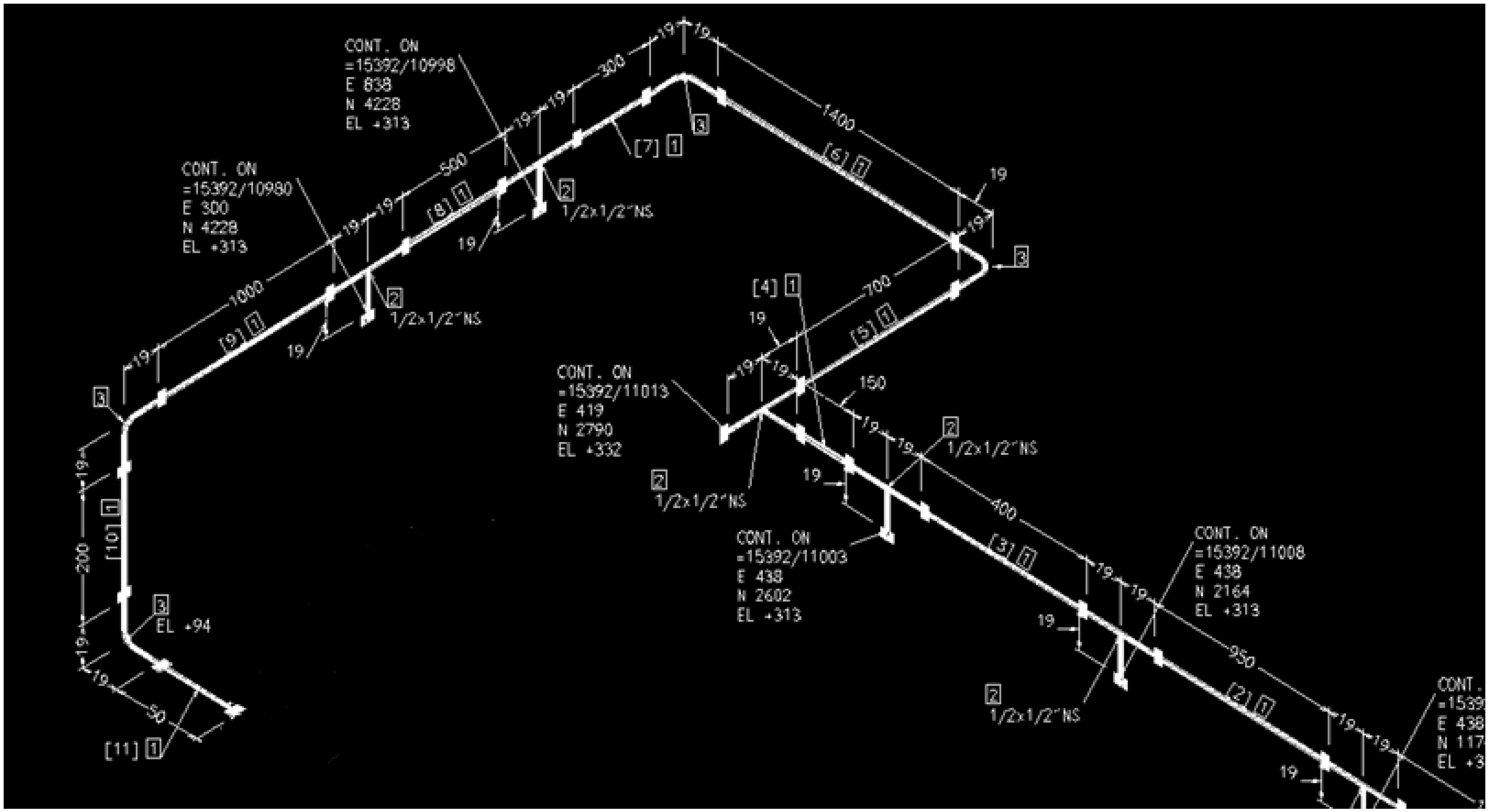

Figure 4.8: Tubing layout at Biotech Lab 2 (Isometric review)

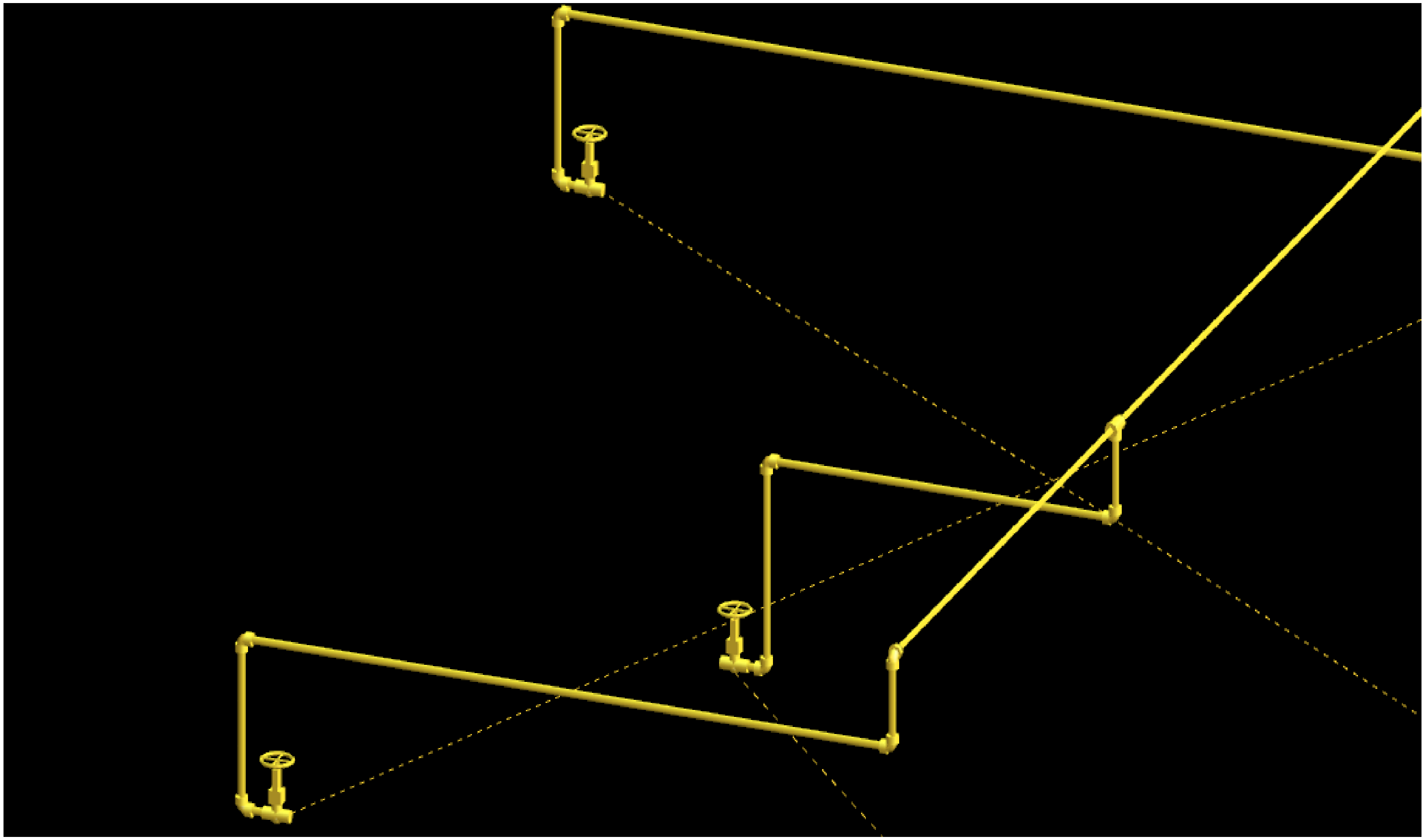

Figure 4.9: Tubing layout at Unit Operation Chemical Reaction and Separation Lab (3D review)

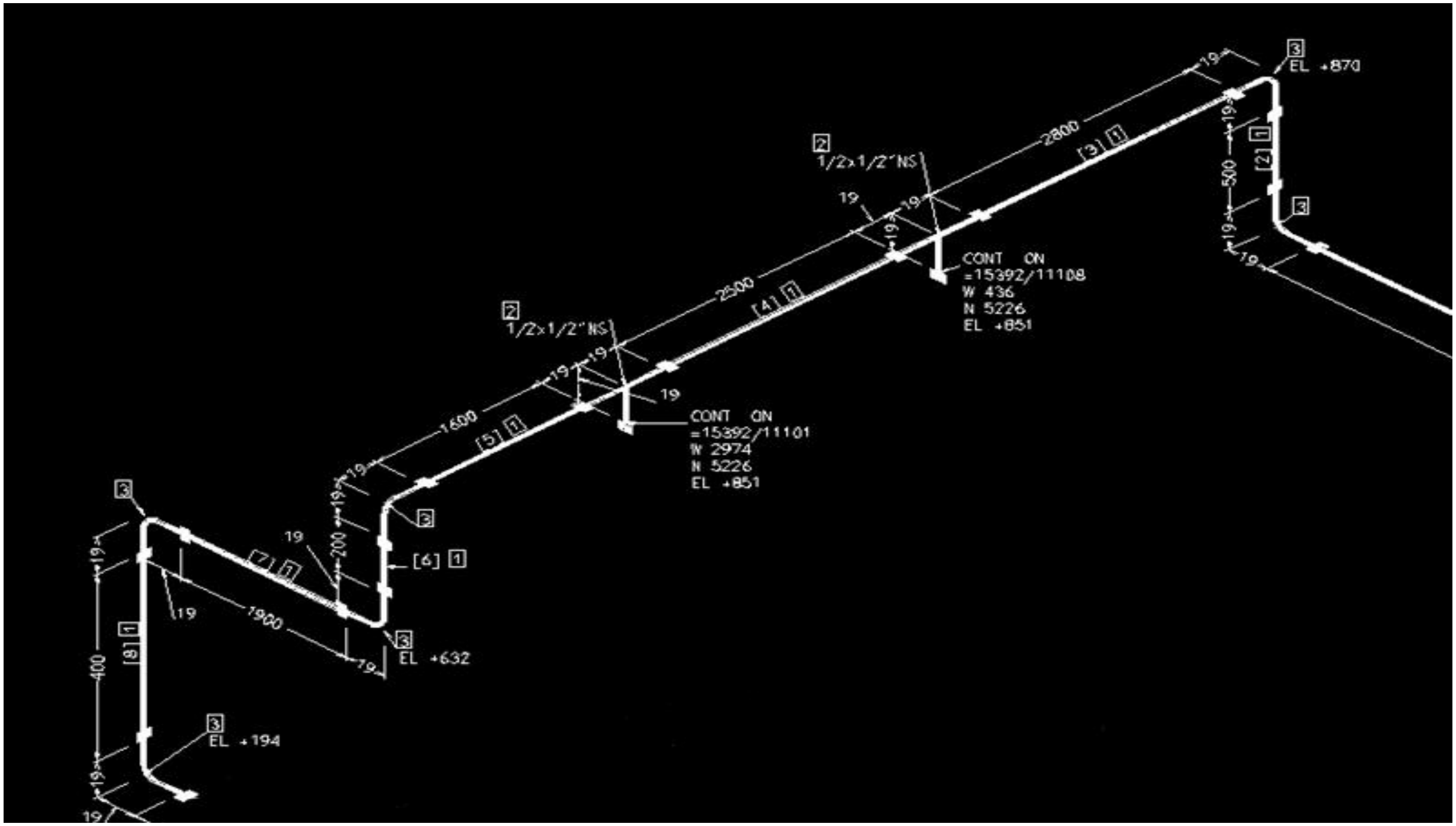

Figure 4.10: Tubing layout at Unit Operation Chemical Reaction and Separation Lab (Isometric review)

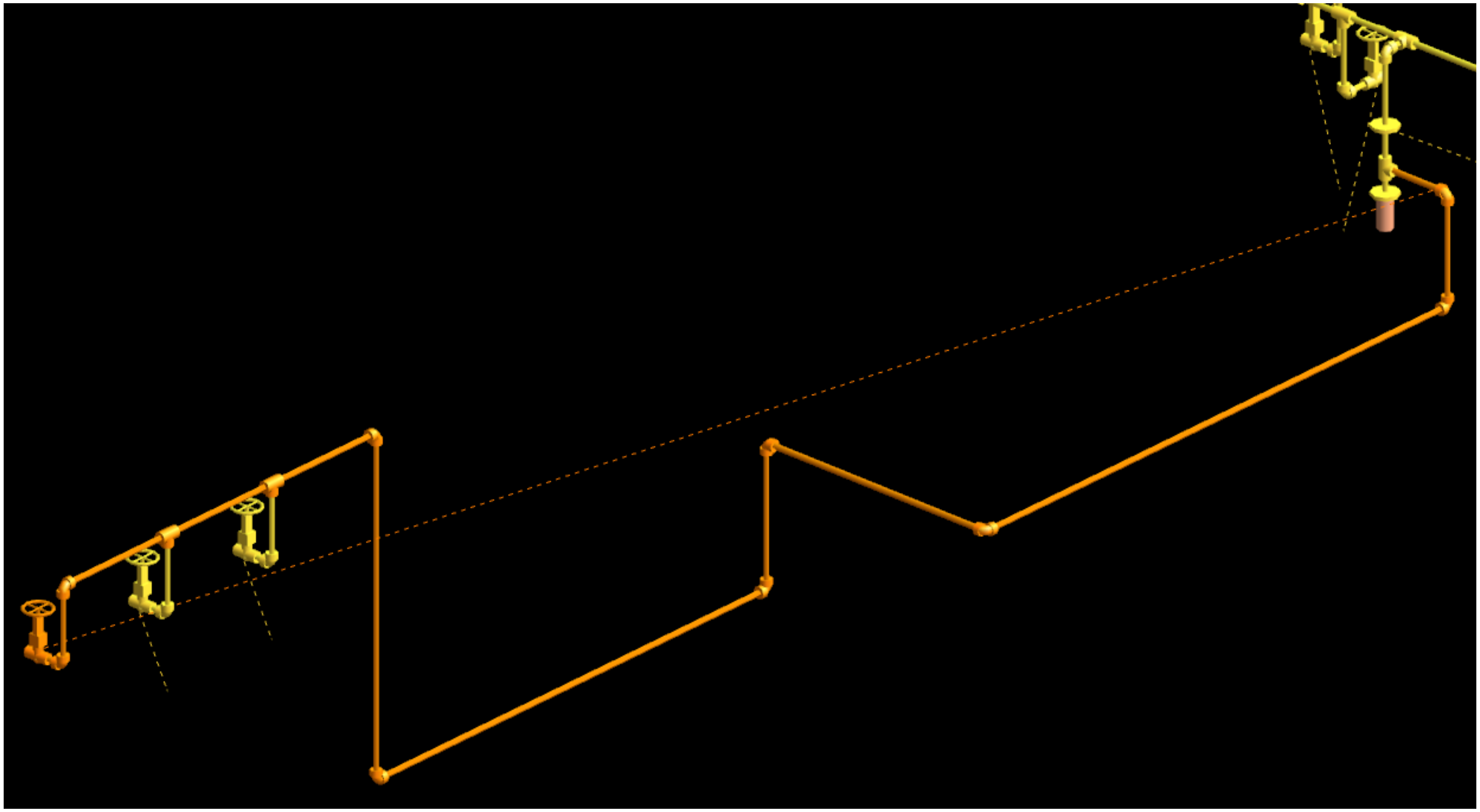

Figure 4.11: Tubing layout at PERKASA Building (3D review)

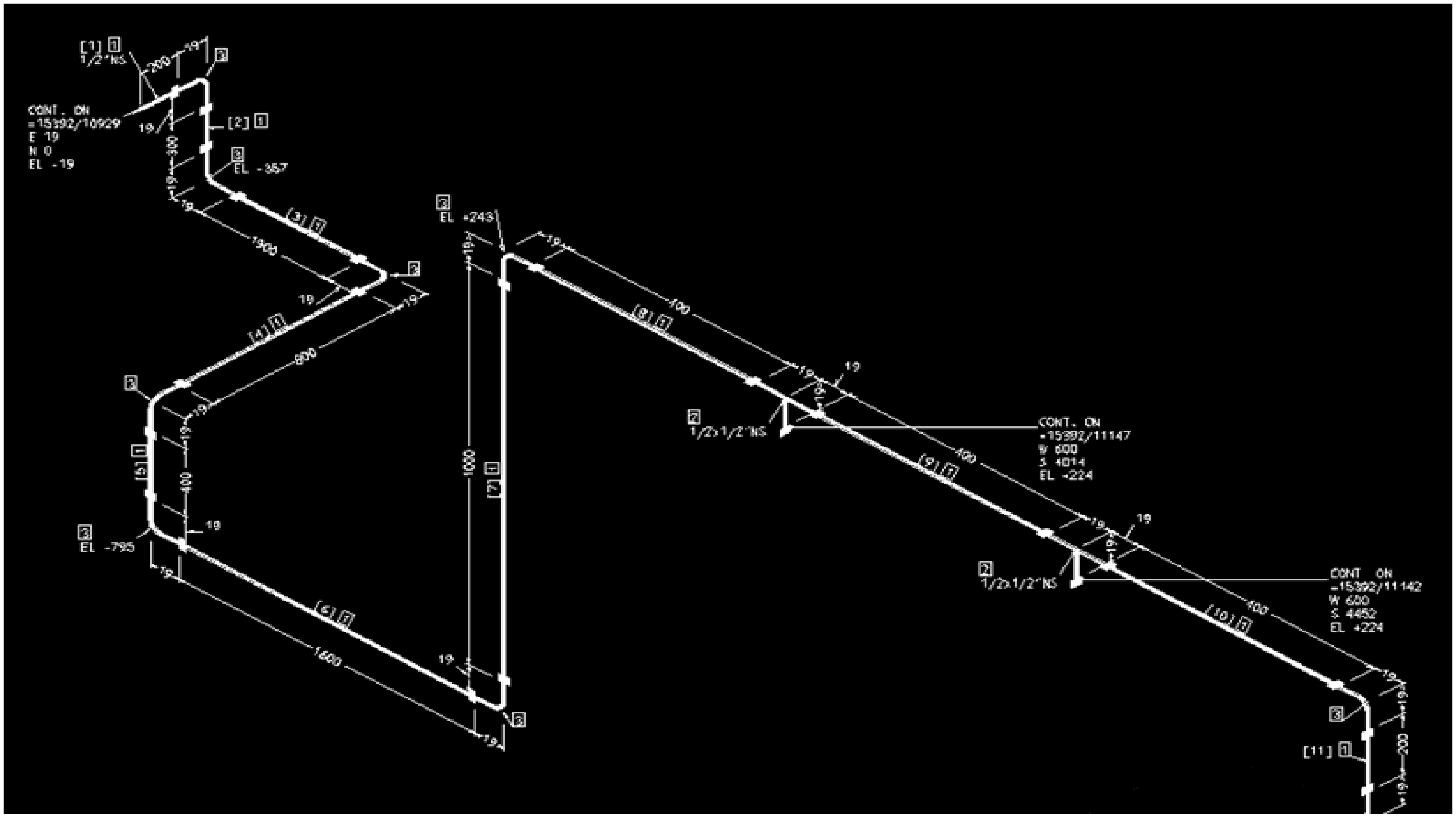

Figure 4.12: Tubing layout at PERKASA Building (Isometric review)

Table 4.1: The gas consumption by the equipment in FKKSA laboratory

Equipment	No. of unit	Flow Rate (kg/hour)										Pressure
		N_2	O_2	CO_2	H_2	He	Argon	N_2O	Ethyne	Air	LPG	
Fermenter 2L	*4*	*0.014*	*0.016*	*0.024*	-	-	-	-	-	-	-	*0.5 bar*
Fermenter 10L	*1*	*0.175*	*0.20*	*0.30*	-	-	-	-	-	-	-	*0.5 bar*
Fermenter 20L	*1*	*0.42*	*0.48*	*0.72*	-	-	-	-	-	-	-	*6 bar*
Fermenter 50L	*1*	*7.0*	*8.0*	*12.0*	-	-	-	-	-	-	-	*3 bar*
Gas Chromatography	*2*	*0.014*	-	-	*0.001*	*0.0002*	-	-	-	-	-	*0.7 bar*
Atomic Absorption Spectrophotometry	*2*	-	*0.08*	-	-	-	*0.02*	*3.268*	*0.288*	*0.08*	-	*1 bar*
Anaerobic Chamber	*1*	*0.2*	-	*0.18*	*0.01*	-	-	-	-	-	-	*0.7 bar*
CO2 Incubator	*1*	-	-	*0.05*	-	-	-	-	-	-	-	*1 bar*
Gas Absorption -Adsorption Unit	*1*	-	-	*1.842*	-	-	-	-	-	-	-	*1 bar*
Bomb Calorimeter	*1*	-	*0.0016*	-	-	-	-	-	-	-	-	*30 bar*
Pressure Swing Adsorption	*1*	*0.07*	-	*0.12*	-	-	-	-	-	-	-	*1 bar*
Supercritical Unit	*1*	-	-	*6.00*	-	-	-	-	-	-	-	*300 bar*
Gas Absorption Refrigeration Unit	*1*	-	-	-	-	-	-	-	-	-	*0.018*	*0.03 bar*
High Performance Liquid Chromatography	*2*	-	-	-	-	-		-	-	-	-	*1 bar*
Flame Propagation and Stability Unit	*1*	-	-	-	-	-	-	-	-	-	*0.02*	*0.5 bar*
Gas Meter Calibration	*1*	-	*1.6*	-	-	-	-	-	-	-	-	*0.04 bar*
Gas Combustion Laboratory Unit	*1*	-	-	-	-	-	-	-	-	-	*10.8*	*2 bar*
Gas Turbine Demonstration Unit	*1*	-	-	-	-	-	-	-	-	-	*26.34*	*5 bar*
Welding Set (GMAW)	*1*	-	-	*0.183*	-	-	*0.165*	-	-	-	-	*3 bar*
Welding Set (GTAW)	*1*	-	-	-	-	-	*1.2*	-	-	-	-	*3 bar*
Differential Scanning Calorimeter	*1*	*0.014*	*0.016*	-	-	-	-	-	-	*0.015*	-	*2 bar*
	TOTAL	*7.907*	*10.4*	*21.42*	*0.01*	*0.0002*	*1.385*	*3.268*	*0.288*	*0.095*	*37.18*	

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Manifolds are used to connect two or more cylinders of gas together increasing the supply volume available to provide a continuous flow when one cylinder is not sufficient and a tube trailer or other bulk supply is not practical. Manifolds are also used when a single cylinder of gas is not capable of supplying the required flow rate required by a process. In a single row configuration designed, manifolds are commonly fabricated for wall mounting with a row of cylinders in line beneath or in front of it. Double row manifolds and other custom configurations are available on request.

Beside that, to isolate individual cylinders on a manifold from service, the station valves are used. As recommendation, station valves are required for most laboratory applications as they are a valuable back up device in the event of a leaking pigtail or a defective check valve. Other than that, in high purity gas service it is most important that station valves used to maintain gas purity. Many commercial manifolds use packed valves that may cause atmospheric impurities to enter the gas stream as contaminants.

Usually, it has two types of pigtails to connect cylinders to the manifold header. Type one call is rigid pigtails made from brass or stainless steel tubing and type two or flexible pigtail made from stainless steel braided hose with either Teflon-lining or stainless steel inner core. Additional, Teflon-lined pigtail are used for routine applications while the stainless steel inner core pigtails are used for ultra high purity applications. More important information, either rigid pigtails or stainless steel inner core flexible pigtails are recommended for helium and hydrogen because these gases will diffuse through the wall of a Teflon-lined pigtail.

Check valves on the cylinder end of each pigtail must be always installed on manifolds used for flammable, toxic and corrosive gases. In some cases, to ensure that highly toxic gases are not released to the working environment during cylinder change outs, the purge assemblies are installed. Many applications required the highly toxic gas are always be supplied to the process. The flow of that gas can not be shut down or stop to replace empty cylinders and gas must feed for long periods when the system is unattended. In this case, a changeover manifold is the solution. Changeover manifolds can be used with any of the multiple station manifolds or with a single pigtail on each side.

The multi cylinder connection system, the system where is essentially modified version of manifold system, required two cylinders with one instrument. For example such as cylinder and bundle manifolds, bundle manifolds, multiple cylinder headers and manifold tutorial. It can be used all at a time or one at a time by only opening and closing the valve. This will simplify the operation and also improves the life of the regulators.

1.2 Problem statement

Currently, Universiti Malaysia Pahang has several laboratories which required Liquefied Petroleum Gas (LPG) and industrial gas to run the experiments and other work related to the use of these gases. FKKSA's laboratory are divided in several areas where the certain areas are required the LPG and industrial gas to run various equipment which use for student training during laboratory session.

The equipments which use LPG and industrial gas are required continuously supply of these gases. So, the manifold system shall be install to ensure that the LPG and industrial gas can be supplied without interruption such as running out of the gas. Beside that, to install the manifold system, safety aspects should be prioritized according to standards and code such as MS 830, MS 930, DOSH and Suruhanjaya Tenaga Guidelines. Additional, the selection of the suitable area must be considered as not all areas can accommodate the gas cylinder.

1.3 Objective of the project

1. To design the manifold system of LPG and industrial gas for FKKSA laboratory.

2. To analyze or study the safety aspect.

1.4 Scope of research work

1. The gas demand
   Gaseous used by various equipments at the lab and type of gas that use at FKKSA Laboratory.

2. Safety aspect
   Data, rules and regulation was based on DOSH, Malaysian standards and Suruhanjaya Tenaga Guidelines.

1.5 Rationale and Significance

1.5.1 Rationale

The manifold system should be install to ensure that the gas can be supply continuously for the equipments.

1.5.2 Significance

To avoid the problem when run the equipment that used the gas such as running out of the gas.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

These studies are focus on the designing the manifold system of LPG and industrial gas for FKKSA laboratory and do the safety assessment. The gas manifold system basically consist the elements like gas cylinder, tubing system, valve, regulator and more. Zainal (2003) has state that gas manifold is use for domestic user, commercial and light industrial. In the engineering lab, where rate of gas consumption is high and it is much advantageous to use a manifold system. So, the capacity of manifolded cylinders must be determined such that enough gas is available to be piped to the appliances at all times. The tanks should be sized such that adequate pressure is maintained to operate the gas system at the rated gas demand of the appliances. Tank sweating will occur when the container is undersized (Suruhanjaya Tenaga).

Beside that, the safety aspect also should be considered because it involved the gas cylinder and flammable gas such as the location, range between the gas cylinder, the type of gas use and more. Other than that, the safety aspect is very important if we want to handle the gas cylinder and shortly, it related to the gas cylinder. It is because for to ensure the worker and public safety are always guaranteed. Before we go to discuss about the safety, we must know or have some information about gas cylinder that use in manifold system such as its properties, type, the material to design gas cylinder, the shape of gas cylinder and more.

Many people mention that the accommodation of gas cylinder is very simple things and does not look to the safety aspect. In reality, we must follow the standards and all rules and also all matters must be consider to accommodate the gas cylinder and will not harmful to consumers, the public and employees. It is because to avoid any accident to occur such as explosion when the gas cylinder is leakage.

2.2 Gas Manifold System

Manifolds and manifold systems are fluid-distribution devices. They range from simple supply chambers with several outlets to multi-chambered flow control units including integral valves and interfaces to electronic networks. Applications, port specifications, flow and pressure specifications, manifold circuit style and valve specifications are all important parameters to consider when searching for manifolds. Additional specifications to consider for manifolds and manifold systems include communication network, body materials, features and operating temperature.

Other than that, the manifold system also known as the multi cylinder connection system and it divided in several types. The example of multi cylinder connection as in Figure 2.1. It consists three of types such as cylinder and bundle manifolds, multiple cylinder headers and bundle manifolds as in the Figure 2.2, Figure 2.3 and Figure 2.4.

Figure 2.1: Multi Cylinder Connection System (Source: Globalspec website)